Remarks

Claims 1-15 are pending in the application. Claims 1 and 3-14 are rejected. Claim 15 is allowed. Claim 2 was cancelled previously. Claim 1 is amended herein. No new matter is added.

CLAIMS

Claim 1 is amended to overcome the Examiners objection.

Claims 1 and 3-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman et al., (U.S. Patent 6,496,184 "Freeman") in view of Heckerman, et al., (U.S. Patent 6,529,891 "Heckerman") and in further view of Skanning et al. (U.S. Patent 6,535,865 "Skanning") and Savakis, et al., (U.S. Patent 6,671,405 "Savakis").

Freeman describes standard belief propagation (also called "probability propagation") between single nodes in a Markov random field (MRF). In the standard belief propagation approach used by Freeman, messages are sent from a single source variable node to a single destination variable node.

The invention groups a plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster and each link is completely contained in at least one cluster. Nodes in intersections of clusters, and intersections of intersections of clusters are defined as regions of nodes. Messages are defined based on the regions of nodes, each message having associated sets of source nodes and destination nodes and a value and a rule depending on other messages and selected links connecting the source nodes and destination nodes. Thus the

messages have associated sets of source nodes and destination nodes as opposed to a single source variable node to a single destination variable node, as in Freeman.

Heckerman describes *training a Bayesian network*. Heckerman's Bayesian analysis is to determine a current state of a system, i.e., "a parameter search is made for a set of changes in the probability parameters of each HSBN which improves the HSBN's ability to ***predict the observed data***, and the HSBN's probability ***parameters are modified*** in accordance with the results of the search." see col. 7, lines 35-40. Bayesian analysis estimates a *current* state of a system based on *prior* observed states of the system. Typically the states are modeled as distributions.

Markov analysis estimates a *future* state of a system based on a *current* state of the system. Typically the states are modeled by probabilities of the states and probabilities of transitions between the states, as in Freeman and the invention. Heckerman does not use probability propagation because it would not make sense given what he is trying to do, which is to train a Bayesian network. Therefore, Heckerman can never be combined with Freeman to make the invention obvious.

Further, the Examiner then points to CL 1, lines 61-65, and col. 7, lines 20-37 of Heckerman as describing the claimed grouping the plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster, and each link is completely contained in at least one cluster. It appears the Examiner asserts that the nodes described in paragraph 1 make up the clusters described in paragraph 7. However, that is incorrect. Heckerman describes ***dividing data into clusters***, not grouping nodes into arbitrary sized clusters as claimed. The Applicants respectfully request the Examiner read the section beginning at col. 6, line 38, through his reference to col. 7, line 37. There, Heckerman clearly describes applying "any number of well-known clustering algorithms to divide the

database into a number of clusters." Col. 6, lines 40-41. Each data cluster of Heckerman is modeled as a Bayesian network, which in turn becomes states (nodes) of a mixture of Bayesian networks (MBN). Nodes are never grouped in arbitrary sized clusters in Heckerman. The Applicants request the Examiner specifically point out where Heckerman groups nodes of a model into arbitrarily sized clusters such that every node is included in at least one cluster, and each link is completely contained in at least one cluster as claimed. Dividing data into clusters using a clustering algorithm can never be used to make obvious grouping nodes of a model into arbitrarily sized clusters as claimed.

Skaaning uses Bayesian networks to troubleshoot, i.e., determine a ***current state***, of a printer system. The examiner asserts that "SK teaches defining messages based on the arbitrary-sized clusters, each message having associated sets of source nodes and destination nodes and a value and a rule depending on other messages and selected links connecting the source nodes and the destination nodes (CL3, L22-23), as the message passing scheme can update the beliefs and probabilities of unobserved nodes given the observed nodes." However, the Applicants cannot understand the Examiner's reasoning. In its entirety, col. 3, lines 22-23 states:

> "In this tree, a message passing scheme can then update the beliefs of all unobserved variables given the observed variables."

Skanning only describes "a message passing scheme." MPEP 2143.03 states "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." In the invention, each message a rule depending on other messages and selected links connecting the source nodes and the destination nodes. The Examiner is requested to specifically point out where

Skaaning describes that his message passing scheme includes a rule depending on other messages and selected links connecting the source nodes and the destination nodes. Nothing in Skaaning describes a rule depending on other messages or selected links. The rejection by the Examiner is a mere conclusion, without a full development of reasons.

Savakis assesses groups of digital images to determine an "emphasis image." The input to Savakis is pixels of a digital image. Savakis clusters the pixels prior to constructing a model. For an illustration of this, see Figures 2 and 3 of Savakis. In Figure 3, clustering of pixels (item 31) occurs before the Bayesian network is constructed. Nodes are never clustered as in the invention. Savakis has not yet generated nodes when his clustering takes place. Therefore, Savakis does not teach grouping the plurality of nodes into arbitrary-sized clusters, or identifying nodes in intersections of clusters, and intersections of intersections of clusters as regions of nodes as claimed.

Savakis identifies intersections of pixels in an image as a preprocessing step before constructing his Bayesian network. Savakis never identifies intersections in node clusters because there are no node clusters described in Savakis. A person of ordinary skill in the art would never confuse identifying intersections of pixels clusters in an image with identifying nodes in intersections of clusters as claimed. Surely, the Examiner does not mean to say pixels are nodes in Savakis. The Applicants respectfully request the Examiner reconsider and withdraw his rejection based on Savakis.

Claim 3: Freeman is directed to standard belief propagation approach where messages are sent from a single source variable node to a single destination variable node. As stated above, the combination of references proposed by the

Examiner fails to describe ***nodes*** grouped into arbitrary sized clusters, grouping the plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster and each link is completely contained in at least one cluster, identifying nodes in intersections of clusters, and intersections of intersections of clusters as regions of nodes, or defining messages based on the regions of nodes.

In claim 4 the initial values of the messages are random positive numbers and in claim 5, the initial values of the messages are all ones. As stated above with respect to claim 1, none of the references describes messages based on the regions of nodes, each message having associated sets of source nodes and destination nodes and a value and a rule depending on other messages and selected links connecting the source nodes and destination nodes. Therefore, Freeman and Heckerman, alone or in combination, can never describe initial values of the claimed messages.

In claim 6, the termination condition is a convergence of the probabilities of the states of the system to a predetermined precision. The claimed messages are defined based on the regions of nodes, which are nodes in intersections of clusters, and intersections of intersections of clusters. None of the references describes messages defined based on regions of nodes and therefore cannot determine approximate probabilities of the states of the system from the messages when a termination condition is reached, as claimed.

In claim 7, approximate probabilities of the states of the system are determined from the messages when a termination condition is reached. In claim 8, the approximate probabilities are maximum a posteriori probabilities. Skaaning never describes messages according to the invention, see claim 1 above. Therefore, Skanning can never determine approximate probabilities from the messages.

In claim 9 the states of the system are discrete. In claim 10, the states of the system are continuous. Heckerman teaches combinations of discrete and continuous variables. That is not what is claimed in either claim 9 or claim 10.

In claim 11, the network model includes closed loops. Freeman describes closed loops in a system where messages are sent from a single source variable node to a single destination variable node. As stated above, the combination of references proposed by the Examiner fails to describe nodes grouped into arbitrary sized clusters, grouping the plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster and each link is completely contained in at least one cluster, identifying nodes in intersections of clusters, and intersections of intersections of clusters as regions of nodes, or defining messages based on the regions of nodes.

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman, Heckerman, Skaaning, and Savakis, in further view of Bertsakis et al, (Data Networks, Prentice Hall, 1992 – "Bertsakis").

Bertsakis fails to cure the defects of Freeman, Heckerman, Skaaning, and Savakis. Nowhere does Bertsakis describe grouping the plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster and each link is completely contained in at least one cluster; identifying nodes in intersections of clusters, and intersections of intersections of clusters as regions of nodes; defining messages based on the regions of nodes, each message having associated sets of source nodes and destination nodes and a value and a rule depending on other messages and selected links connecting the source nodes and destination nodes.

The arrangement of nodes in a square or rectangular lattice according to claims 12 and 13 respectively, are preferred node configurations for the novel method for determining probabilities of states of a system represented by a model including a plurality of nodes connected by links in claim 1.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman, Heckerman, Skaaning, and Savakis, in further view of Helfenstein et al., (U.S. Patent 6,282,559 – "Helfenstein").

Helfenstein describes nodes and links as a Markov network representation of an error correcting code. How then, can Helfenstein's Markov network be combined with the Bayesian networks described in Heckerman, Skaaning and Savakis? Helfenstein cannot be combined with Heckerman, Skaaning, and Savakis. The combination of references proposed by the Examiner can never make the invention obvious.

Further, Helfenstein fails to cure the defects of Freeman, Heckerman, Skaaning, and Savakis. Nowhere does Helfenstein describe grouping the plurality of nodes into arbitrary-sized clusters such that every node is included in at least one cluster and each link is completely contained in at least one cluster; identifying nodes in intersections of clusters, and intersections of intersections of clusters as regions of nodes; defining messages based on the regions of nodes, each message having associated sets of source nodes and destination nodes and a value and a rule depending on other messages and selected links connecting the source nodes and destination nodes.

All rejections have been complied with, and applicant respectfully submits that the application is now in condition for allowance. The applicant urges the Examiner to contact the applicant's attorney at phone and address indicated below if assistance is required to move the present application to allowance. Please charge any shortages in fees in connection with this filing to Deposit Account 50-0749.

Respectfully submitted,
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